

Energy Efficiency in Italy: energy consumption trends and policies in 2000-2022

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Notes

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List of abbreviations

Acquirente Unico	AU
Collective Self-Consumption	CSC
Decree Law	D.L.
Effort Sharing Regulation	ESR
Energy Efficiency Directive	EED
Energy Management Expert	EME
Energy Performance of Buildings Directive	EPBD
Energy Poverty Indicators Calculation	EPIC
EU statistics on income and living conditions	EU-SILC
Gestore dei Servizi Energetici	GSE
Greenhouse Gas	GHG
Gross Domestic Product	GDP
Gross Inland Consumption	GIC
Italian National Agency for New Technologies, Energy and Sustainable Economic Development	ENEA
Italian National Observatory of Energy Poverty	ONPE
Legislative Decree	L.D.
Legislative Decree	Lgs.D.
Millions of euros	MEUR
Ministerial Decree	M.D.
Ministry of Economy and Finance	MEF
Ministry of Environment and Energy Security	MASE
Ministry of infrastructures and transport	MIT
National Integrated Energy and Climate Plan	NECP
National Recovery and Resilience Plan	NRRP
Programme for the Energy Renovation of Buildings owned by Central PA	PREPAC
Programme for the Energy Renovation of Buildings owned by PA	PREPA
Public Administration	PA
Renewable Energy Directive	RED
Small Medium Enterprises	SME
Staff Working Document	SWD
Third Sector Entities	TSE
Tonnes of oil equivalent	toe
Value Added	VA

1 Introduction

The EU has set the objective of climate neutrality in Europe by 2050 and energy security. The EU issued the legislative package "Fit for 55" and the Energy Efficiency Directive (EED III, Directive EU/2023/1791) and the Energy Performance of Buildings Directive (EPBD IV, Directive EU/2024/1275) to achieve this objective. In particular, the EED III directive imposes an 11.7% reduction in energy consumption by 2030 so that the final energy consumption of the EU does not exceed 763 Mtoe of final energy and 992.5 Mtoe of primary energy. The EU assigns Italy a target of 93 Mtoe of final energy consumption by 2030.

Energy efficiency is a key element for achieving the objectives because reducing energy consumption it reduces CO₂ emissions and energy dependence.

This report analyses the trends in energy consumption and the policies in force to achieve the targets.

In the last years energy consumption in Italy returned to the decreasing trend after the COVID19 pandemic. In 2022 gross inland consumption was 15.2% less than in 2000. All energy sources are reducing with the exception of renewable energy sources that in 2022 tripled their consumption compared to 2000 reaching a share of 19% in primary energy consumption. Final consumption decreased by 7.5% compared to 2000: only renewable energy sources and electricity were increasing.

Energy intensity, both primary and final, confirmed the good results achieved by Italy: -21.1% for primary intensity and -14.0% for final intensity.

The energy efficiency index ODEX showed an annual improvement in energy efficiency of 1.1% in the period 2000-2022.

The NECP was updated in June 2024 and it is the main and comprehensive Italian energy policy framework. The Plan estimates a consumption of 123 Mtoe in primary energy and of 102 Mtoe in final energy in 2030, while the expected energy savings from energy efficiency measures will be equal to 73.4 Mtoe. The Plan establishes also that further measures will be evaluated to achieve the European energy consumption targets.

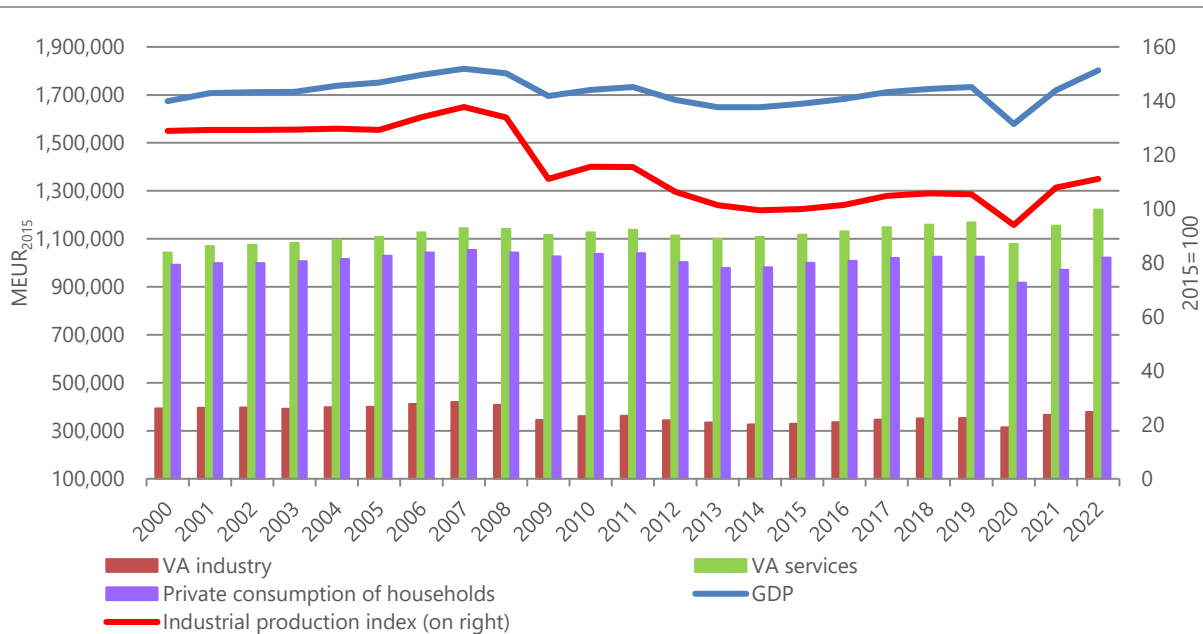
The Italian strategy on Energy Poverty is still under development. Consequently, the current Italian policy framework for fighting energy poverty rely on energy efficiency deployment in buildings through current support schemes coherent with the objective of counteracting energy vulnerability in domestic consumption. Such schemes mostly address structural and energy renovation of buildings and the diffusion of energy efficient technology.

2 Economic and energy efficiency context

2.1 Economic context

In 2022, GDP amounted to 1,800 billion euros, chain-linked year 2015, with an increase of 4.7% compared to 2021. Over the period 2000-2022 GDP increased by 7.5%: GDP had two significant drops in 2009 (-5.3%) and in 2020 (-8.9%) because of economic crisis and COVID19 pandemic, respectively. All components of demand showed the same trend as GDP: in particular, value added of services grew by 16.5% and private consumption of households by 2.6%. On the other hand, industry had a decrease in the period 2000-2022: -3.1% in value added and -13.8% in industrial production.

Figure 1: Evolution of GDP and components



Source: Eurostat, Istat

2.2 Policy background

The NECP was updated in June 2024 and it is the main and comprehensive Italian energy policy framework. The NECP establishes the national targets for 2030 regarding energy efficiency, renewable energy, reduction of CO₂ emissions, energy security, electrical interconnectivity and energy transmission infrastructure, competitiveness, development and sustainable mobility.

The Plan estimates a consumption of 123 Mtoe in primary energy and of 102 Mtoe in final energy in 2030. The estimated consumption of the NECP in 2030 is not in line with the EU target in EED III that assigns a final energy consumption of 93 Mtoe to Italy. The Plan establishes that further measures in the ESR sectors¹ will be evaluated to achieve the energy consumption target.

The expected energy savings from energy efficiency measures will be equal to 73.4 Mtoe in the period 2021-2030, in line with EED III.

¹ Transport sector, buildings, agriculture, waste management services and Small and Medium Enterprises.

The minimum percentage targets for energy savings to be achieved between 1 January 2021 and 31 December 2030, according to Article 8, paragraph 1 of EED III are shown in the table 1.

Table 1: Energy savings to be achieved in 2021-2030 according to Article 8, paragraph 1 of EED III

Year	Energy savings/ %	Annual energy savings in Mtoe										Total year in Mtoe	Total cumulative year in Mtoe
		2021	2022	2023	2024	2025	2026	2027	2028	2029	2030		
2021	0.80	0.93										0.93	0.93
2022	0.80	0.93	0.93									1.85	2.78
2023	0.80	0.93	0.93	0.93								2.78	5.56
2024	1.30	0.93	0.93	0.93	1.51							4.28	9.84
2025	1.30	0.93	0.93	0.93	1.51	1.51						5.79	15.63
2026	1.50	0.93	0.93	0.93	1.51	1.51	1.74					7.53	23.16
2027	1.50	0.93	0.93	0.93	1.51	1.51	1.74	1.74				9.26	32.43
2028	1.90	0.93	0.93	0.93	1.51	1.51	1.74	1.74	2.20			11.47	48.89
2029	1.90	0.93	0.93	0.93	1.51	1.51	1.74	1.74	2.20	2.20		13.67	57.56
2030	1.90	0.93	0.93	0.93	1.51	1.51	1.74	1.74	2.20	2.20	2.20	15.87	73.42

Source: Italian NECP, 2024

The "Dimension energy efficiency" section of the NECP is dedicated to illustrating the measures for energy efficiency. In particular, the measures in force and monitored for achieving the energy savings target referred to Article 8 of EED III are

- White Certificates obligation scheme: last update is M.D. 21 May 2021. A new update is underway to strengthen the mechanism. The promotion of eligible interventions in the residential and services sector and transport sector will be essential. The NECP estimates annual energy savings equal to 9.5 Mtoe by 2030.
- Tax deduction scheme for the energy renovation of existing buildings: fiscal incentives for making buildings more energy efficient. The incentive measures that adopt the tax deduction mechanism differ in terms of the tax deduction, interventions, beneficiaries and duration: Superbonus, Ecobonus and Bonus Casa. The expected annual energy savings by 2030 are estimated to be equal to 32.5 Mtoe
- Thermal Account: is the instrument for private parties and the PA to implement energy efficiency interventions and to produce thermal energy from renewable sources. It is the only incentive measure for the PA. The measure is currently being updated to take into account the directives on energy performance in buildings (EPBD), energy efficiency (EED) and the promotion of renewable sources (RED). The NECP estimates annual energy savings by 2030 equal to 4.8 Mtoe.

- National Energy Efficiency Fund: it is a fund to finance energy efficiency interventions. The Fund has been fully operational since May 2019. The annual energy savings are expected equal to 0.7 Mtoe by 2030.
- Transition Plan 4.0 and 5.0: it is a measure that brings together various legislative interventions to support the transition of production processes to an efficient, sustainable and renewable energy model. The measure grants a tax credit to enterprises that invest in innovation projects resulting in a reduction in energy consumption. The NECP estimates annual energy savings by 2030 equal to 6.6 Mtoe, assuming the measures are in force until 2030.
- Programme for the Energy Renovation of Buildings owned by Public Administration (PREPA, ex PREPAC). The program has the objective of making at least 3% per year of energy renovation of the air-conditioned useful covered area of the buildings owned by PA. The measure covers 100% of eligible costs. The evaluation of the projects takes place with the technical support of GSE and ENEA, the granting of financing is carried out by MASE. The expected annual energy savings by 2030 are estimated to be equal to 0.54 Mtoe from new projects implemented from 2025 onwards and estimated on the basis of Article 6 of EED III.
- National Information and Training Plan for Energy Efficiency: three-year information and training program aimed at promoting and facilitating the efficient use of energy. The program is implemented by ENEA starting from 2021 and until 2030. The annual energy savings by 2030 are expected equal to 1.7 Mtoe.
- Kyoto Fund: it is a fund intended to finance measures aimed at implementing the Kyoto Protocol. The NECP estimates annual energy savings by 2030 equal to 4.2 Mtoe
- NRRP measures: measures M2C3-I.3.1, M2C1-I.3.1, M2C2-I.1.1, M2C3-I.1.1, M2C3-I.1.2, M1C3-I.1.3, M2C4-I.2.2, M4C1-I.3.3 and M5C2-I.2.3. The expected annual energy savings are estimated to be equal to 0.4 Mtoe by 2030.
- Cohesion policy. The NECP estimates annual energy savings by 2030 equal to 0.07 Mtoe.
- Energy savings target for the PA. The annual energy savings by 2030 are expected equal to 1.19 Mtoe.
- Application of minimum energy performance requirements for buildings and thermal installations management, set by the EPBD Directive. The expected annual energy savings by 2030 is 3.7 Mtoe. This estimate is net of energy savings from other incentive measures and the effects of the application of the update on the management of heating systems of Presidential Decree n.74/2013.
- Sustainable mobility measures: modal shift in freight transport (Marebonus, Ferrobonus), renewal of the local public transport fleet, vehicle replacement incentives. As a result of the set of measures planned to promote energy efficiency in the transport sector, the expected cumulative annual energy savings by 2030 will be equal to approximately 7.5 Mtoe of final energy.

The measures, already active or to be activated, adopted by Italy to achieve the final energy savings calculated in accordance with Article 8, paragraph 1 of EED III are summarised in the table 2.

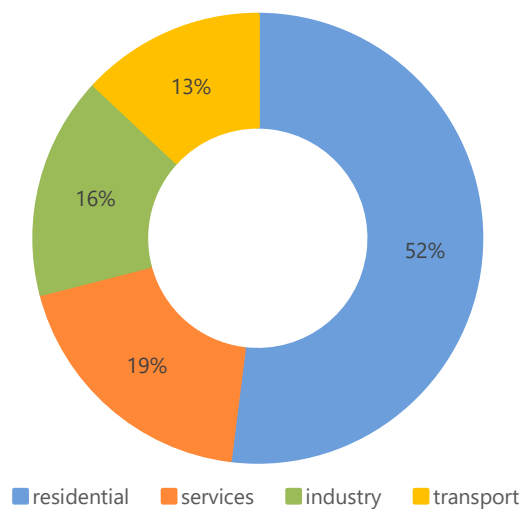
Table 2: Expected annual energy savings in Mtoe by measure in 2021-2030

Measures	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
White Certificates	0.11	0.32	0.47	0.63	0.83	1.03	1.23	1.43	1.63	1.83	9.51
Tax deduction	0.52	1.39	2.25	2.92	3.39	3.73	4.07	4.4	4.74	5.08	32.49
Thermal Account	0.09	0.15	0.23	0.33	0.43	0.52	0.62	0.72	0.81	0.91	4.81
National Energy Efficiency Fund	0.01	0.02	0.03	0.05	0.06	0.08	0.09	0.11	0.12	0.14	0.71
Transition Plan 4.0 and 5.0	0.07	0.14	0.21	0.28	0.44	0.66	0.88	1.1	1.32	1.54	6.64
PREPA					0.03	0.05	0.08	0.1	0.13	0.15	0.54
National Information and Training Plan	0.04	0.1	0.12	0.14	0.16	0.18	0.2	0.22	0.24	0.26	1.66
Kyoto Fund	0.07	0.15	0.22	0.3	0.37	0.45	0.53	0.61	0.69	0.77	4.16
NRRP measures						0.08	0.08	0.08	0.08	0.08	0.4
Cohesion policy	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.07
Energy saving target for the PA				0.03	0.06	0.08	0.15	0.22	0.29	0.37	1.2
Minimum energy performance	0.06	0.13	0.19	0.26	0.33	0.4	0.47	0.54	0.61	0.68	3.67
Mobility measures	0.44	0.56	0.62	0.68	0.68	0.91	0.91	0.91	0.91	0.91	7.53

Source: Italian NECP, 2024

An indicative assessment of the cumulative savings expected by 2030 by sector is shown in the figure 2.

Figure 2: Energy savings expected by 2030 by sector



Source: Italian NECP, 2024

3 Overall energy efficiency progress and policies

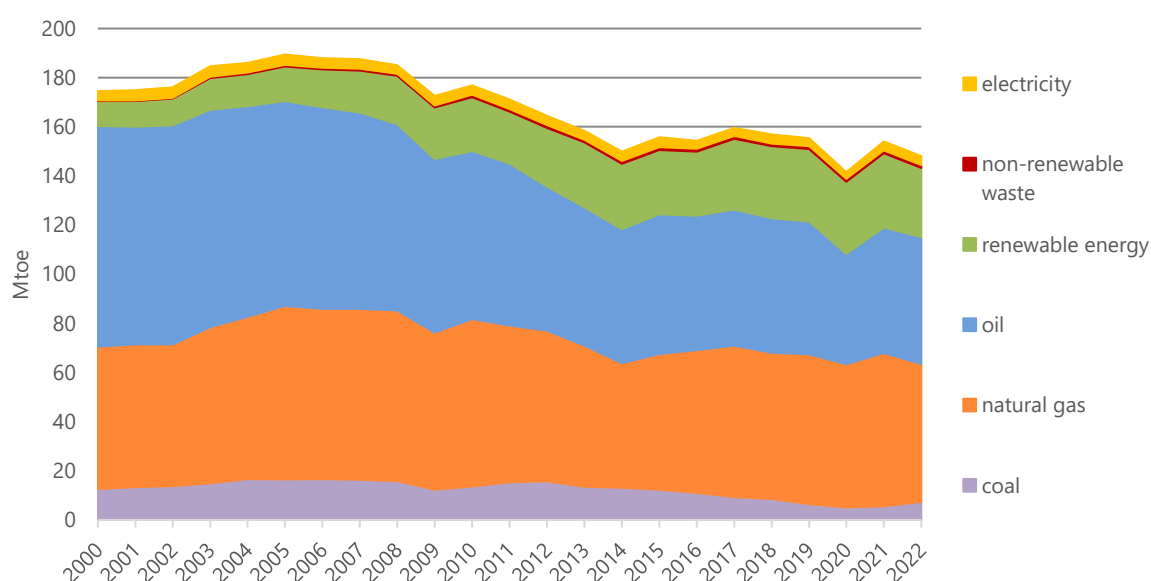
3.1 Energy consumption and energy efficiency trends

3.1.1 Energy consumption

Gross inland consumption in 2022 was 148.1 Mtoe, -3.9% compared to 2021, mainly due to the drop in final energy consumption with -3.4%. Over the period 2000-2022, gross inland consumption decreased by 15.2%.

Natural gas is the main energy source: in 2022 natural gas covered 37.9% of inland energy demand with 56.1 Mtoe, -10.1% compared to 2021. The share of natural gas has been decreasing in recent years due to the high price and the ban on Russian gas following the Russia-Ukraine war. Oil and petroleum products covered 34.8% of inland energy demand followed by renewable energy sources with 19%. The renewable energy consumption amounted to 28.2 Mtoe in 2022: primary solid bio-fuels were around 30% of renewable energy, followed by geothermal energy with 18.4%, ambient heat with 9.8% and hydro energy with 8.7%.

Figure 3: Gross Inland Consumption by energy source

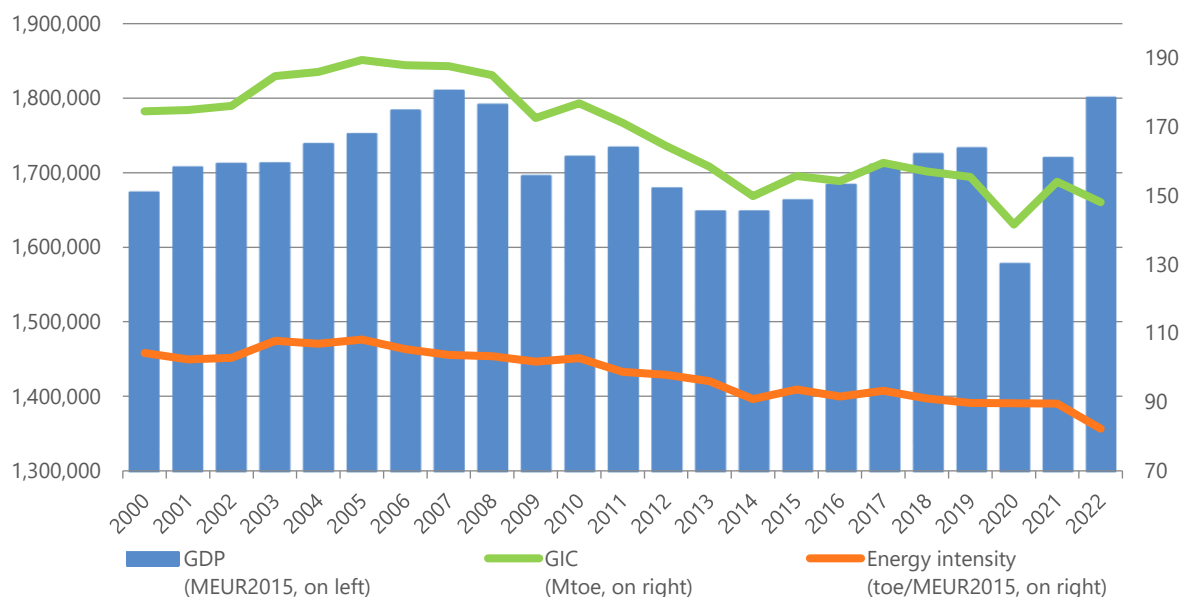


Source: Eurostat

Primary energy intensity, calculated as ratio between gross inland consumption and GDP, in 2022 was equal to 82.3 toe for millions of euros of GDP chain-linked year 2015, -8.2% compared to 2021 because of a reduction in gross inland consumption (-3.9%) and a growth in GDP (+4.7%).

Energy intensity in the period 2000-2022 had a generally decreasing trend, determined by a better performance of GDP than GIC: GDP grew more than gross inland consumption in expansionary periods (2000-2007) and contracted less in recessionary phases (2008-2014). Energy intensity over the period 2000-2022 decreased by 21.1%, going from 104.3 toe/MEUR₂₀₁₅ in 2000 to 82.3 toe/MEUR₂₀₁₅ in 2022.

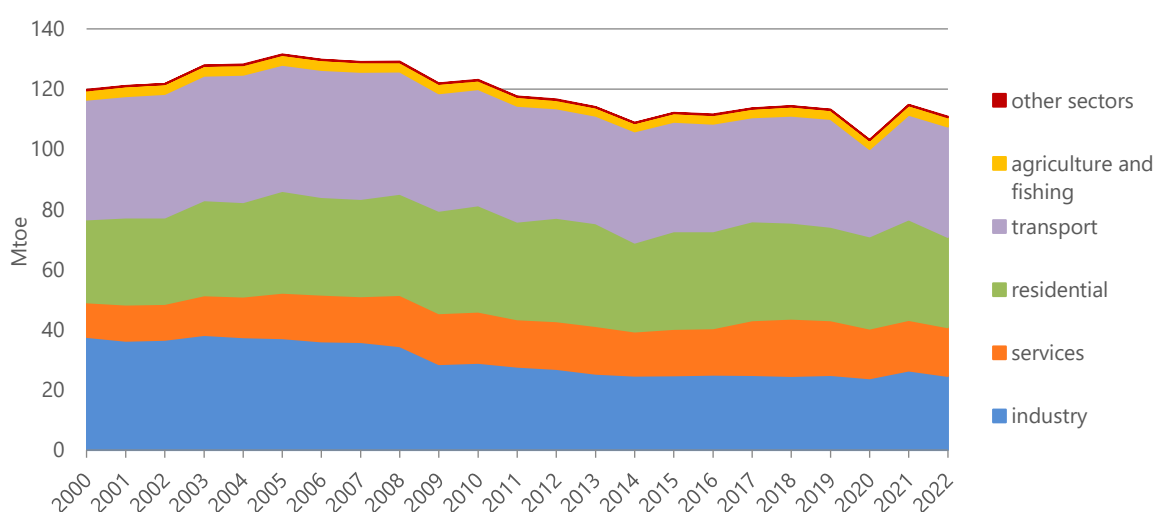
Figure 4: GDP, Gross Inland Consumption and primary energy intensity



Source: Eurostat

In 2022, final energy consumption amounted to 110.8 Mtoe, -3.4% compared to 2021: after the anomalous years of 2020 and 2021 due to the COVID19 pandemic, final energy consumption resumed the decreasing trend of the last pre-pandemic years. In detail, energy consumption is decreasing in residential sector with -1.0% compared to 2021, in industry -6.9%, in services -4.0%, and in agriculture and fishing -2.4%, while energy consumption in transport sector is increasing by +5.4%. In the period 2000-2022 final energy consumption decreased by 7.5%.

Figure 5: Final energy consumption by sector



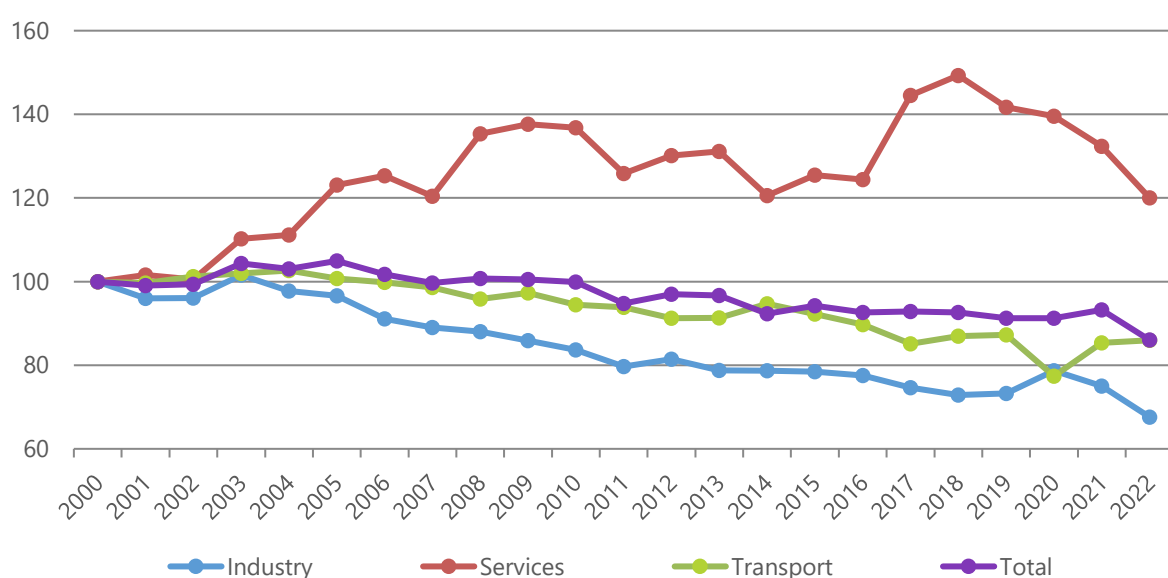
Source: Eurostat

In the period 2000-2022 energy consumption dropped by 35.5% in industry caused by contraction in industrial production, changes in the production structure and improvement in energy efficiency, by 7.6% in transport sector, by 1.8% in agriculture and fishing. On the other hand, energy consumption in services and residential sectors increased by 39.8% and 8.9%, respectively, due to the growth of activities in services and changes in lifestyle and living comfort in households despite the energy efficiency achieved by residential sector.

In 2022 residential and services sectors absorb approximately 40% of final energy consumption, 10 percentage points more than in 2000. The share of energy consumption is around 20% for industry (10 percentage points less than in 2000) and around 30% for transport sector.

Final energy intensity, calculated as ratio between final energy consumption and GDP, in 2022 was equal to 61.3 toe for millions of euros of GDP chain-linked year 2015, -7.7% compared to 2021 due to a reduction in final energy consumption (-3.4%) and a growth in GDP (+4.7%). Energy intensity had a generally decreasing trend, -14.0% in the period 2000-2022: industry and transport sector contributed to the reduction of energy intensity. On the other hand, energy intensity of the services sector has shown a generally increasing trend, +20.0% in the period 2000-2022, confirming its driving role in the Italian economy.

Figure 6: Final energy intensity by sector

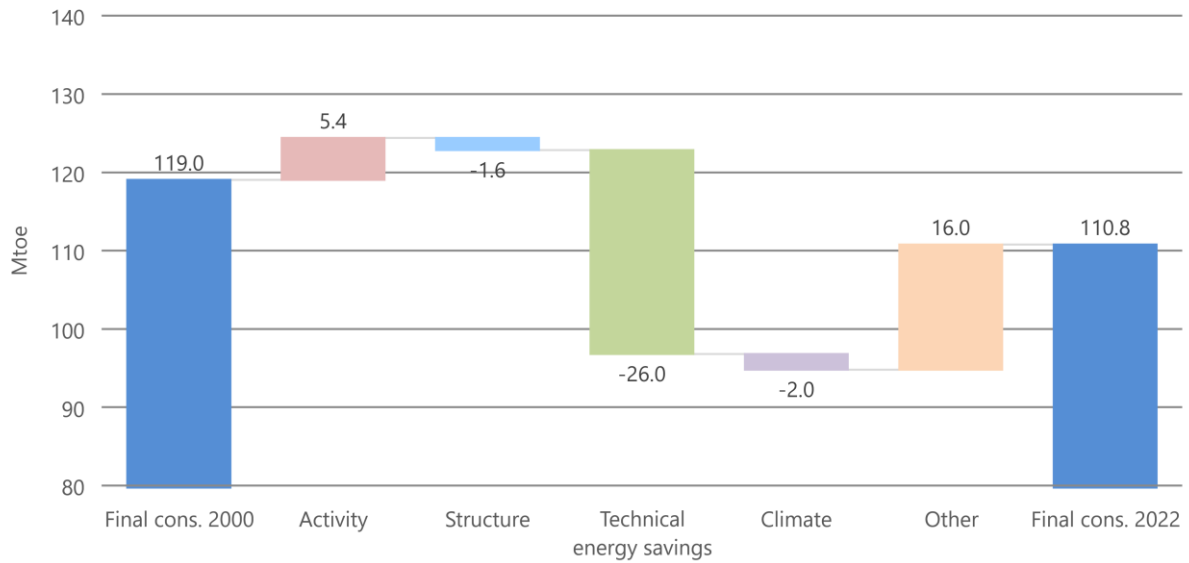


Source: Eurostat, Istat

3.1.2 Decomposition of final energy consumption and energy efficiency index

Final energy consumption decreased by 8.2 Mtoe between 2000 and 2022. The activity effect determined an increase in energy consumption of 5.4 Mtoe mainly due to the growth of the services sector (+17.1% in VA and +39.8% in energy consumption) and to more dwellings and appliances per dwelling in households. Technical energy savings amounted to 26 Mtoe: 10.2 Mtoe came from industry, 9.2 Mtoe from transport sector, 6.0 Mtoe from residential sector and 0.6 from services sector. Other effects increased energy consumption by 16 Mtoe: these effects are mainly greater comfort and other behavioural changes, non-used production capacity, low load factor in passenger and goods traffic.

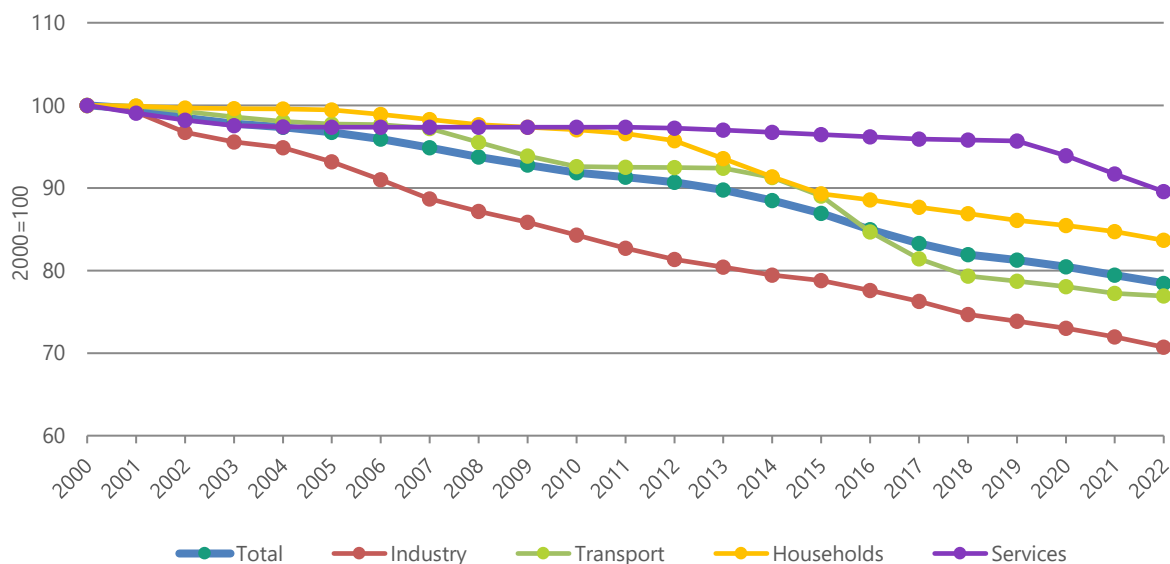
Figure 7: Variation in final energy consumption in 2000 - 2022



Source: Odyssee

Energy efficiency of final consumers, as measured by ODEX, improved by 21.5% over the period 2000-2022 at an average of 1.1% per year. The highest progress in energy efficiency was achieved by the industry: 1.6% per year for an overall improvement of 29.3% over the period 2000-2022. In transport sector the progress in energy efficiency was 1.2% per year, with an acceleration in the years 2015-2018 due to an increase in passenger traffic greater than energy consumption. The improvement in residential and services sectors was slower: 0.8% per year in residential sector and 0.5% per year in services sector.

Figure 8: Technical energy efficiency index



Source: Odyssee

3.2 Cross cutting energy efficiency policies

The Legislative Decree n.73/2020 transposes the directive EU/2018/2002 on the Energy Efficiency First Principle into the Italian regulatory framework. The Lgs.D. amends the Lgs.D. n.102/2014. The Lgs.D. contributes to the implementation of the energy efficiency first principle.

The Lgs.D.

- updates the figure of the Energy Management Expert: a person certified by UNI CEI 11339 standard that also performs energy audit compliant with the UNI CEI EN 16247 standards. EME coincides with the energy auditor in the activities relating to the execution of energy audits.
- indicates the minimum national energy efficiency contribution for 2030: it's defined in the NECP and notified to the European Commission. The NECP sets the indicative target of energy savings at 43% of primary energy (39.7% of final energy). The period for the energy savings target has been extended: it is between 1 January 2021 and 31 December 2030 and subsequent periods.
- deletes the mandatory energy audit for large enterprises with annual energy consumption less than 50 toe.
- forces that by 2023 enterprises with high energy consumption have an EME compliant with the ISO 50001 standard or, alternatively, implement at least one energy efficiency intervention among those defined in the energy audit.
- provides incentives for SME for the implementation of energy management systems compliant with the ISO 50001 standard and for energy audits every two years until 2030.
- starts the new Thermal Account by 30 June 2021, more focused on the non-residential sector, both public and private.
- provides for the possibility of adopting alternative or additional methods in addition to the White Certificates to achieve the national quantitative energy savings targets.
- extends to 2030 the PREPAC.

Ministerial Decree 10 August 2022 allocated 2 billion euros for the Fund for development and cohesion (FSC 2021-2027) to finance investments to help decrease direct GHG emissions through electrification, the use of renewable hydrogen instead of fossil fuels, and the reduction of energy consumption.

The 2020 Budget Law grants the Municipalities for the years 2020-2024 a maximum of 500 million euros per year to carry out one or more public in energy efficiency and territorial development. The grants assigned to the Municipalities vary from 50,000 euros to 250,000 euros according to their population. The municipality benefiting from the subsidy is required to start the works by 15 September of each reference year of the grant.

White Certificates obligation scheme was updated by Ministerial Decree 21 May 2021. The annual energy savings achieved by White Certificates in 2023 according with Article 8 of EED III in 2023 was 0.633 Mtoe.

The Thermal Account regulation is being updated and will take into account the update of the EPBD, EED and RED Directives. In the Thermal Account 3.0 Decree draft, the participating entities and eligible interventions are expanded. The annual energy savings achieved by Thermal Account in 2023 was 0.245 Mtoe.

The energy savings achieved in recent years under the Article 8 of EED III with cross cutting measures are summarized in table 3.

Table 3: Annual energy saving in Mtoe per yeat according to EED, Article 8

Measures	2021	2022	2023
White Certificates	0.113	0.315	0.633
Thermal Account	0.086	0.152	0.245
National Energy Efficiency Fund	0.002	0.004	0.006
Cohesion policy	0.011	0.013	0.032
National Information and Training Plan	0.045	0.102	0.106

Source: Annual Energy Efficiency Report 2024, ENEA

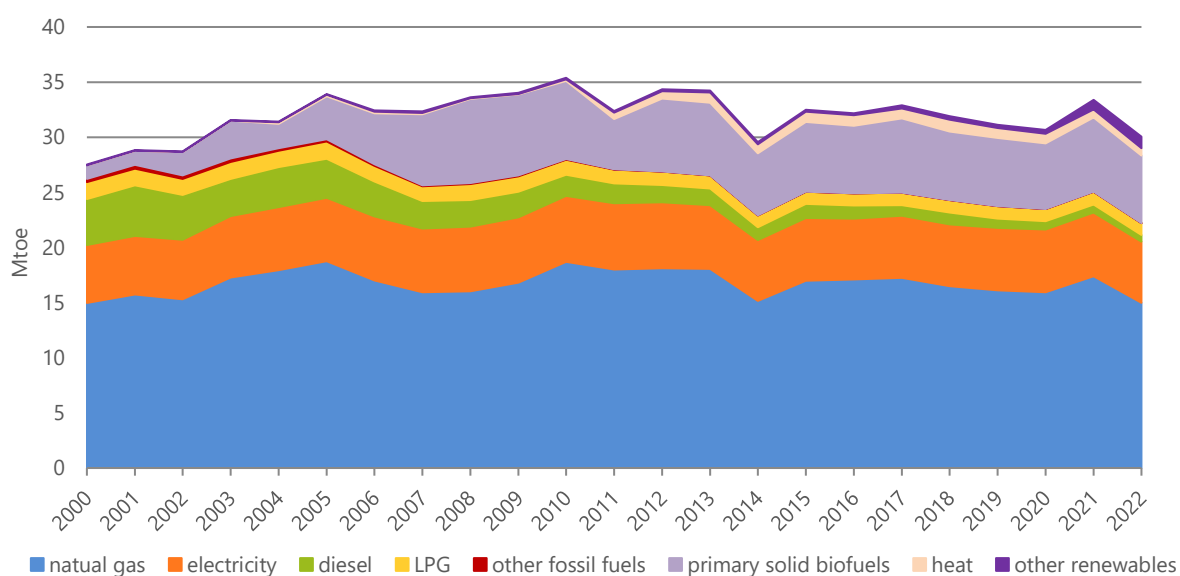
4 Sectoral energy efficiency progress and policies

4.1 Residential sector

Energy consumption in the residential sector in 2022 was 30.0 Mtoe, -10.0% compared to 2021. All energy sources decreased: natural gas by -14.0% due to high prices and a milder winter compared to 2021, solid biofuels by -9.2%, electricity by -3.7%, petroleum products by -10.7%. Only other renewable energy sources showed a growing consumption: +20.4% compared to 2021 for ambient heat, also as replacement for natural gas for space heating, and +8.5% for solar thermal.

Over the period 2000-2022, the energy consumption increased by 9.2%, result of 2 phases: a growth phase until 2010, in which energy consumption was 35.4 Mtoe, followed by a contraction phase except for 2021 due to the post-COVID19 pandemic. Residential consumption has decreased by 15.1% since 2010 due to actions to improve energy efficiency, both regulatory (minimum requirements for new buildings) and financial/fiscal through incentives for the implementation of energy efficiency interventions.

Figure 9: Energy consumption in residential sector by energy source



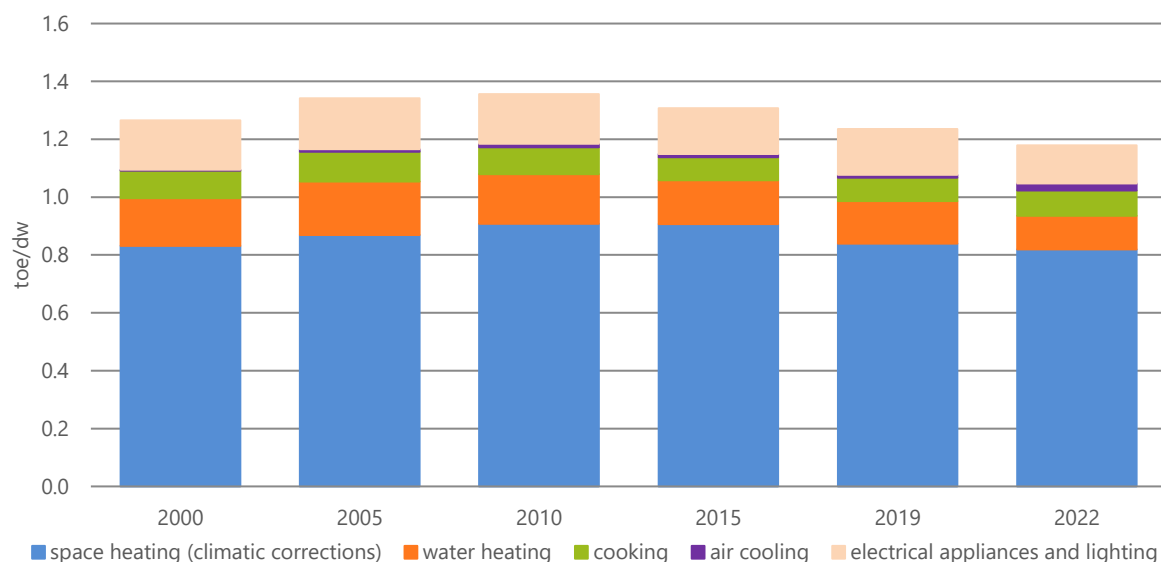
Source: Eurostat

Natural gas is the first energy source in the residential sector: it covers approximately 50% of total consumption, followed by primary solid biofuels and electricity with approximately 20% and 18% of energy consumption, respectively. Natural gas consumption decreased by 19.9% since 2010. On the other hand, primary solid biofuels had an average annual growth rate of +7.6% in the period 2000-2022. Electricity consumption also increased in the period 2000-2022, +5.8%. Other renewable energy sources had a strong growth in consumption, due also to their use as an alternative to natural gas consumption, mainly ambient heat and solar thermal. Heat consumption remains practically stable.

The consumption per dwelling with climatic corrections decreased by 8.2% in the period 2000-2022. Space heating absorbed almost 70% of energy consumption per dwelling in 2022, followed by electrical appliances and lighting (11%) and water heating (10%). Over the period 2000-2022 the

unit consumption decreased by 1.5% for space heating, by 22.4% for electrical appliances and lighting and by 29.3% for water heating. Unit consumption for air-cooling increased in the period 2000-2022.

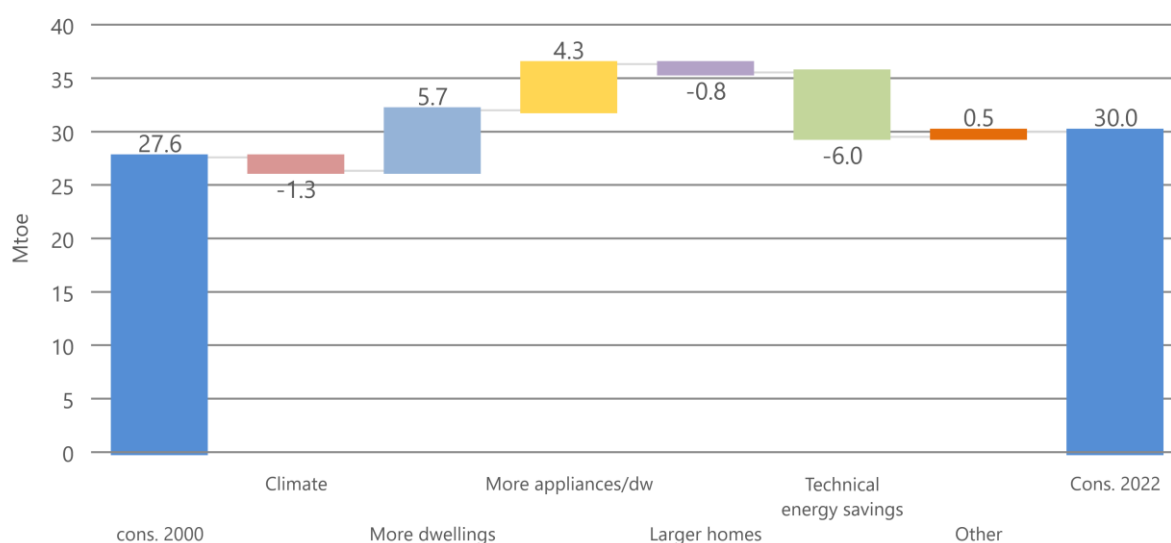
Figure 10: Energy consumption per dwelling by end-use



Source: Odyssee

The energy consumption of residential sector grew by 2.4 Mtoe between 2000 and 2022. This increase was mainly due to two factors: more dwellings for 5.7 Mtoe and greater comfort and lifestyle for 4.3 Mtoe, especially more appliances per dwelling. Energy savings limited energy consumption increase by 6 Mtoe. The climate effect also reduced the energy consumption for 1.3 Mtoe. Other effects had a slight increasing impact of 0.5 Mtoe.

Figure 11: Variation of final energy consumption in residential sector in 2000 - 2022



Source: Odyssee

Legislative Decree n.48/2020 amended Lgs.D n.192/2005 to promote the improvement of the energy performance of buildings. The Lgs.D.

- obliges new buildings or buildings undergoing major renovations, both residential and non-residential, are equipped with technologies for recharging electric vehicles.
- requires the adoption of the "Long Term Renovation Strategy" in order to support the renovation of the national residential and non-residential buildings stock, both public and private, to obtain a decarbonised and energy-efficient building stock by 2050. The Strategy proposes policies and actions to accelerate the energy requalification of all public buildings, the integration of energy efficiency interventions in buildings with interventions for the reduction of seismic and fire risk.
- establishes that government incentives to promote energy efficiency during the renovation of buildings are commensurate with the energy savings pursued or achieved.

National portal on the energy performance of buildings, created and managed by ENEA², provides citizens, businesses and the PA with information on the energy performance of buildings, on best practices for cost-effective energy renovations and on the incentive schemes to improve the energy performance of buildings.

The Italian National Recovery and Resilience Plan allocated 191.5 billion euros for energy efficiency in buildings, financed through the Recovery and Resilience Facility, to which are added a further 30.6 billion euros of national resources. In particular, the Component C3 of Mission 2 aims to improve the efficiency of public and private buildings, also by integrating renewable energies. This component includes 15.36 billion euros in total for energy efficiency measures across 3 lines of action:

- M2C3.1 energy efficiency improvements of school buildings and judiciary buildings.
- M2C3.2 energy efficiency improvement and seismic renovation of public and private residential buildings through the temporary incentive.
- M2C3.3 district heating.

The main energy efficiency policies currently in force are Ecobonus and Superbonus.

Ecobonus was introduced by Law n.296/2006 and subsequent amendments and integrations. It is a tax deduction scheme for the energy renovation of existing buildings.

Superbonus was introduced by Decree Law n.34/2020, converted with amendments into Law n.77/2020, was promulgated in the aftermath of the COVID-19 pandemic for the recovery of the economy. The Decree allocates part of the total budget to enhancing energy efficiency and renewable installations. In particular, the Decree establishes a 110% tax deduction (Superbonus) for expenses incurred from 1 July 2020 for the implementation of specific interventions aimed at energy efficiency and static consolidation or the reduction of the seismic risk of buildings.

The 2025 Budget Law reduced the tax deductions for building renovations from 50% to 36% in 2025 and 30% in 2026-2027. The Superbonus measure has been gradually weakened from 2023.

The energy savings achieved by tax deduction in recent years under the Article 8 of EED III are summarized in table 4.

² <https://pnpe2.enea.it>

Table 4: Annual energy saving in Mtoe per year by tax deduction

Measures	2021	2022	2023
Ecobonus	0.228	0.412	0.558
Bonus Casa	0.080	0.151	0.222
Superbonus	0.197	0.778	1.236
Bonus facciate	0.017	0.022	0.024
Total	0.522	1.363	2.039

Source: ENEA

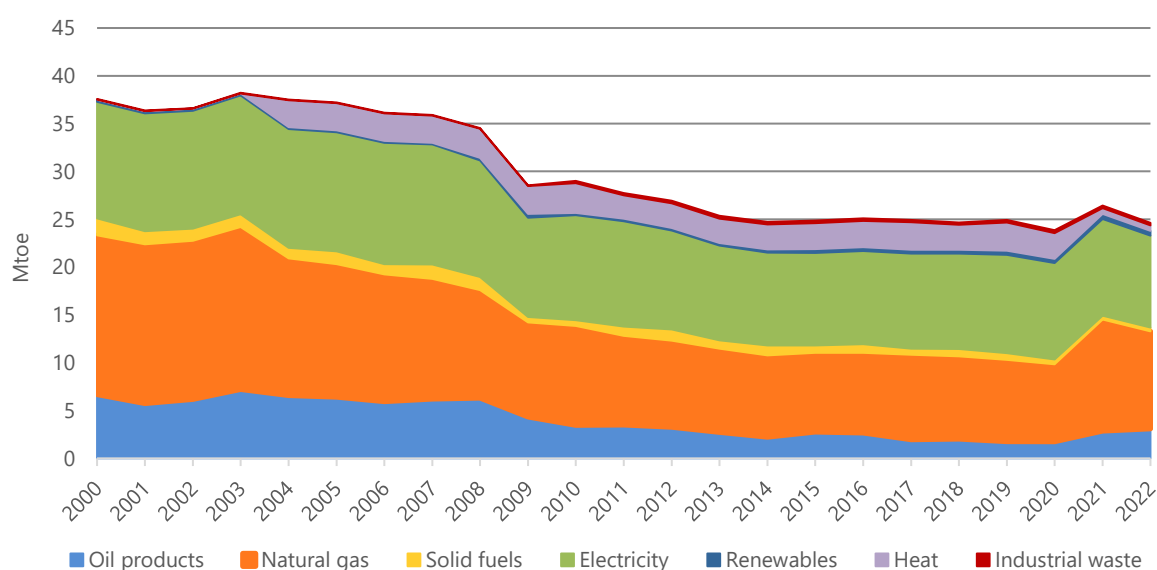
4.2 Industry sector

Energy consumption in industry sector in 2022 was 24.6 Mtoe, -6.9% compared to 2021: natural gas and electricity consumption decreased by 12.9% and 5.0%, respectively, while the consumption of oil products increased by 9.3% and solid fuels by +1.3%, mainly due to the replacement of natural gas.

Apart from the years of the COVID19 pandemic, industry consumption had a decreasing trend: in the period 2000-2022, industry reduced energy consumption by 34.5%, equal to 13 Mtoe. The drop affected all energy sources: oil products decreased by 53.4% (-3.4% annual average), solid fuels by 79.3% (-6.9%), natural gas by 38.9% (-2.2% annual average) and electricity by 21.3% (-1.1% annual average). Electricity and natural gas are the main energy sources in the sector: they cover approximately 80% of the energy consumption.

Since the White Certificates mechanism came into force in 2005 and the following actions to improve energy efficiency, energy consumption in industry reduced by 33.8%.

Figure 12: Energy consumption in industry sector by energy source



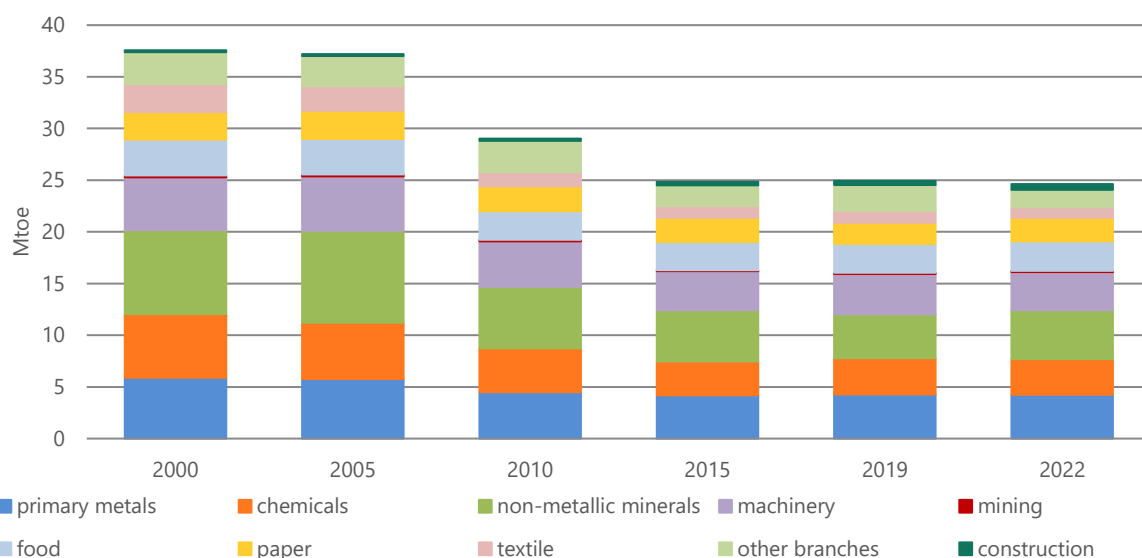
Source: Eurostat

All industrial branches had a similar trend in reducing energy consumption, while value added decreased less or even increased confirming the improvements in energy efficiency. In particular, in the period 2000-2022 energy consumption decreased by 44.2% in chemical industry (-0.4% in VA),

by -41.5% in non-metallic minerals (-14.9% in VA), by -28.1% in primary metals (-26.3% in VA) and by -28.0% in machinery, transport equipment included (+11.6% in VA), by -19.2 in food and beverages (+21.5% in VA).

Energy-intensive sectors accounted for 59.7% of energy consumption in 2022.

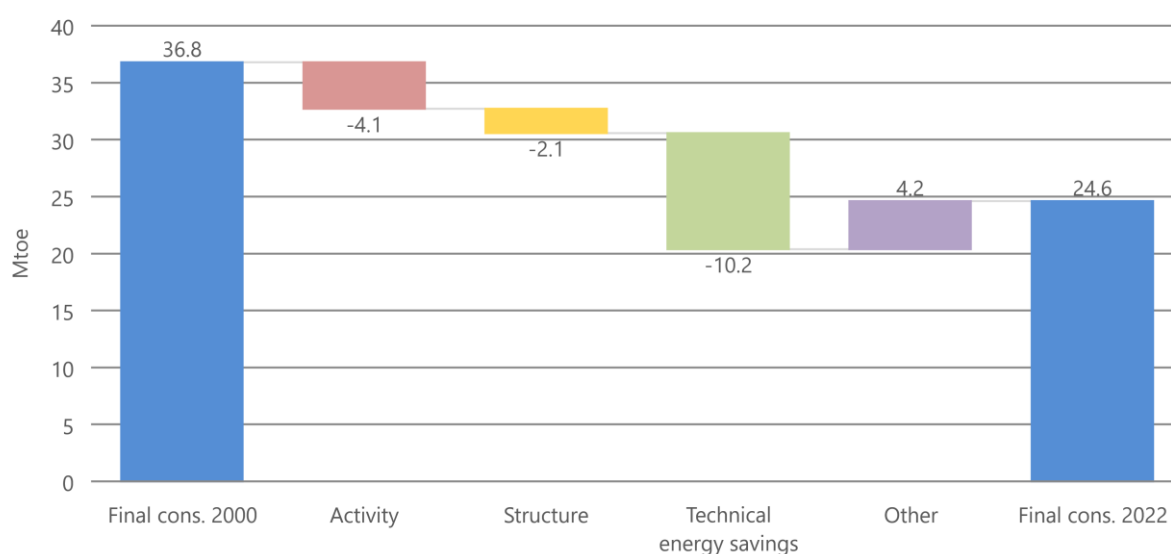
Figure 13: Energy consumption in industry sector by branch



Source: Eurostat

The energy consumption of industry in 2022 reduced by 12.2 Mtoe compare with 2000. This decrease was mainly driven by energy savings for 10.2 Mtoe and by a lower industrial activity for 4.1 Mtoe, mostly due to the economic crisis and recession in years 2007-2015. The effect of the structural changes towards less intensive branches contributed to lower consumption by 2.1 Mtoe. The other effects, mainly non-used production capacity, increased energy consumption by 4.2 Mtoe.

Figure 14: Variation of final energy consumption in industry sector 2000 - 2022



Source: Odyssee

The Transition Plan 5.0, established by art. 38 of Lgs.D n.19/2024 and converted into Law n.56/2024, grants a tax credit to enterprises that invest in innovation projects resulting in a reduction in energy consumption.

The Plan provides approximately 13 billion in the two-year period 2024-2025. The tax credit is proportional to the expenditure incurred for the investments made and depends on the reduction in final energy consumption (at least 3 percent) or energy savings in processes (at least 5 percent) due to investments in digital activities. The aim is achieving energy savings of 0.4 Mtoe in the period 2024-2026.

Projects must be certified by an independent evaluator, with ex ante and ex post certifications. At least 4.032 billion euros of the investment must contribute to climate goals. The measure includes a tax credit scheme for expenditures incurred between 1 January 2024 and 31 December 2025.

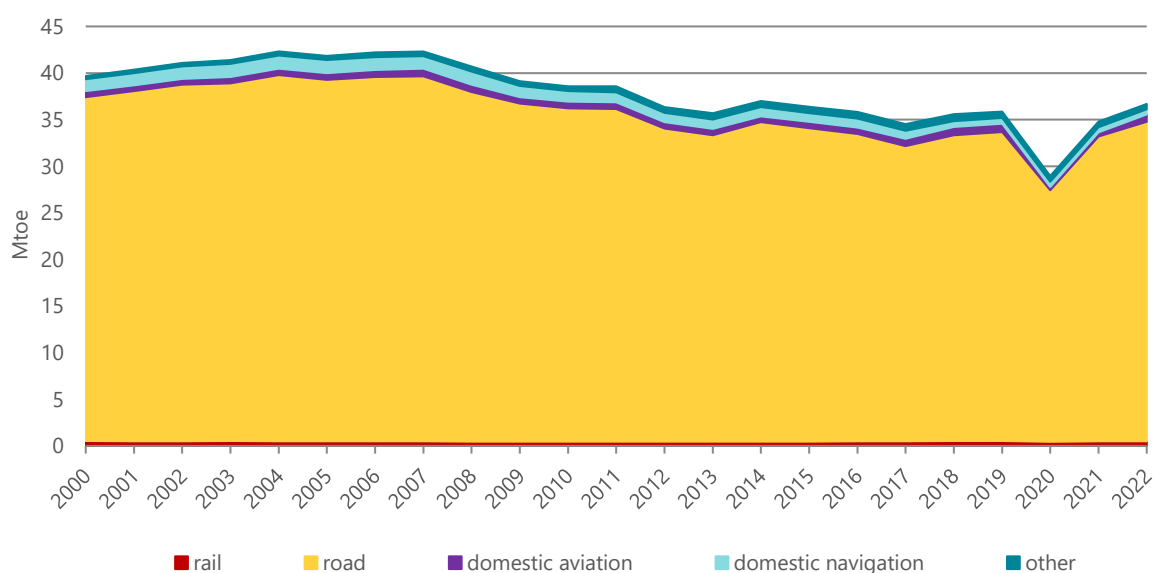
Companies will be granted an automatic tax credit, without any preliminary assessment, without limits on the size of the company, the sector of activity or its location. Investments in tangible and intangible assets will be facilitated, provided that a reduction in energy consumption of at least 3% is achieved (or 5% if calculated on the process affected by the investment).

4.3 Transport sector

Energy consumption in the transport sector in 2022 was 36.7 Mtoe, +5.4% compared to 2021. All transport modes increased: +4.8% in road transport, +72.4% in domestic aviation, +1.4% in rail transport. Only domestic navigation had a decrease of -1.2% in energy consumption.

Road transport absorbs over 90% of energy consumption: in 2022 its consumption was 34.3 Mtoe. Energy consumption in road transport has been growing since 2017 with the exception of 2020 due to the COVID19 pandemic.

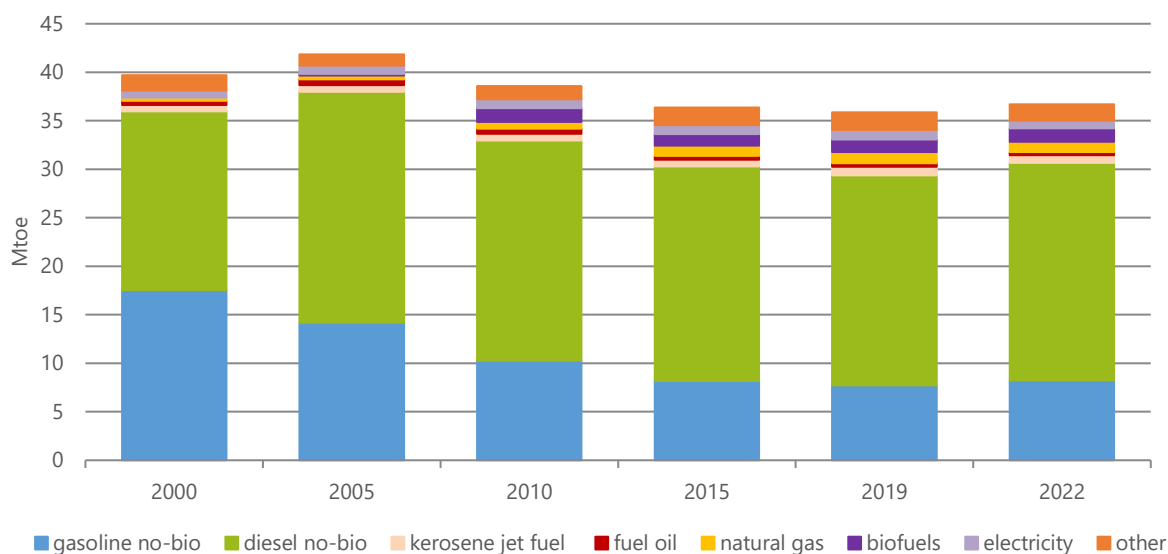
Figure 15: Energy consumption in transport sector by mode



Source: Odyssee

The weight of road transport influences the use of energy sources: in 2022 oil products cover 91% (97% in 2000) of energy consumption, mainly diesel (61% in 2022 against 46% in 2000) and gasoline (22% in 2022 against 44% in 2000), followed by biodiesel with 3.7% in 2022, natural gas with 2.9% and electricity with 2.1%.

Figure 16: Energy consumption in transport sector by energy source

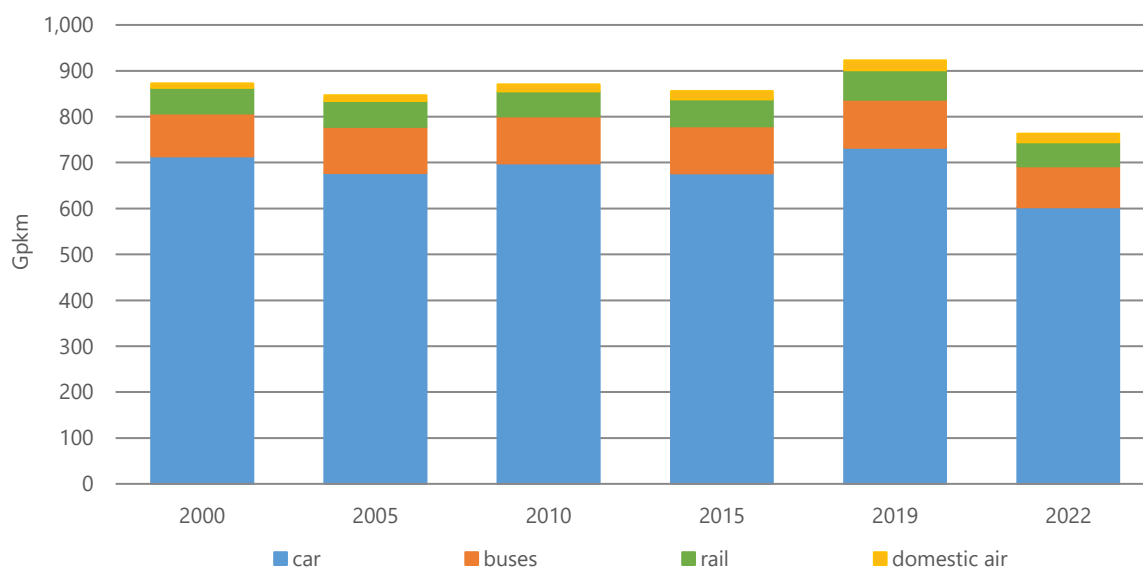


Source: Eurostat

Passenger traffic peaked in 2019: 922.8 Gpkm in 2019, +5.7% compared to 2000. The COVID19 pandemic caused passenger traffic to fall down to 552.1 Gpkm in 2020. In 2022, passenger traffic is not yet at pre-pandemic levels: 763.1, -17.3% compared to 2019.

Passenger traffic is over 90% on the road: passenger traffic by car was 79.0% in 2022, followed by bus with 11.6%, and rail with 6.9% and domestic air with 2.4%. Over period 2000-2022 the share of cars decreased by 2.8 percentage points while the other transport modes increased: 0.9 percentage points in buses, 0.6 in rail and 1.3 in domestic air.

Figure 17: Passenger traffic by mode

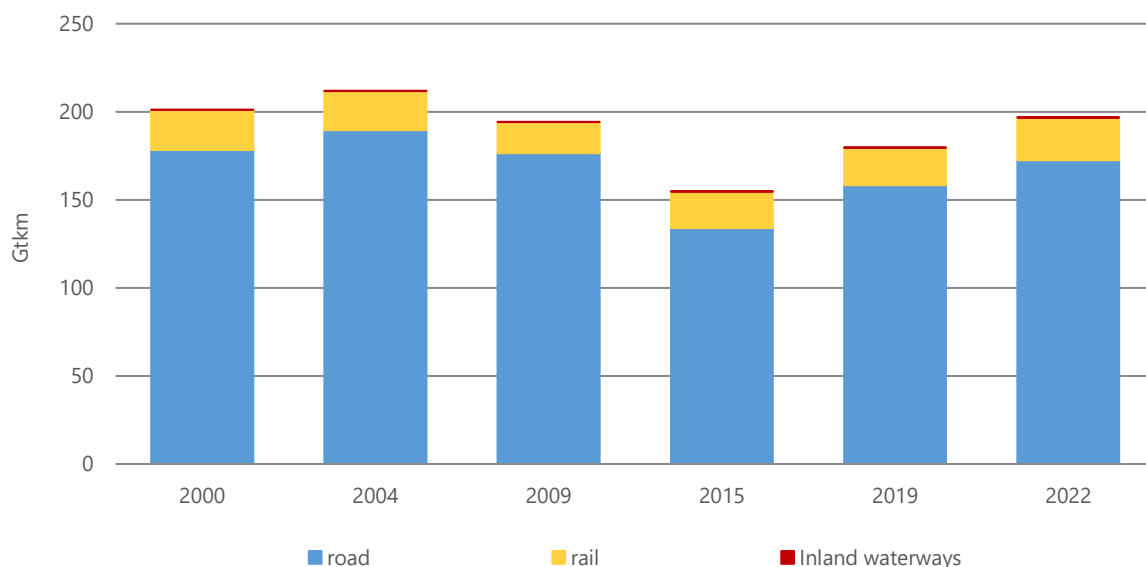


Source: Odyssee

The freight traffic was increasing since 2014, +28.5% in 2014-2022 but -3.3% compared to 2000. The drop over the period 2000-2014 is driven by the significant decrease in road goods traffic (-

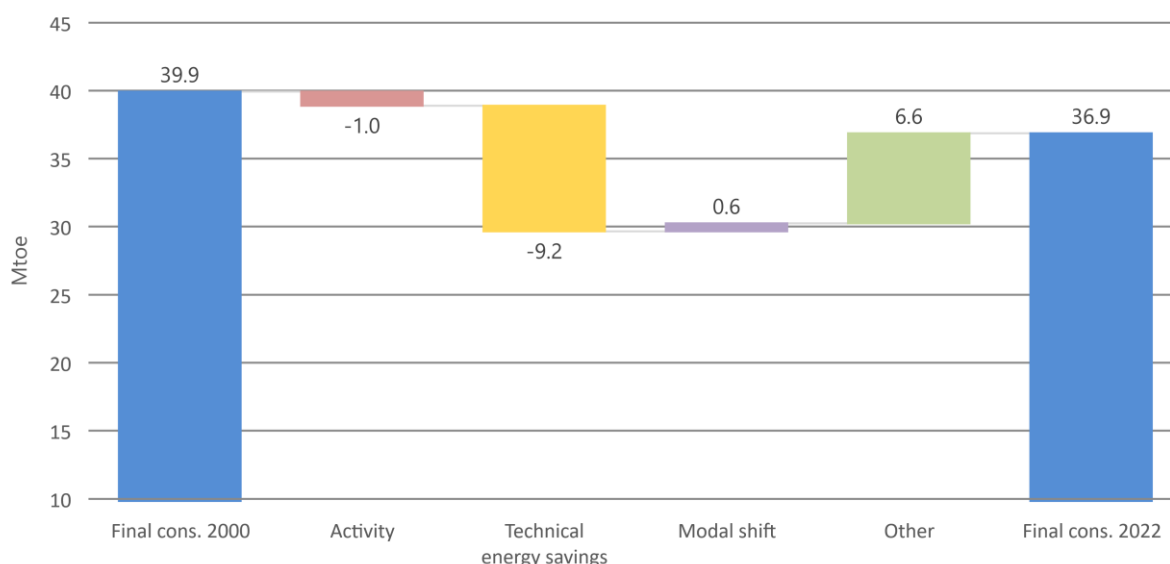
2.1%/year), especially since 2010, and in rail traffic (-0.9%/year). Road goods traffic was around 88% over the period 2000-2022.

Figure 18: Freight traffic by mode



Over the period 2000-2022, energy consumption of sector reduced by 3.4 Mtoe compare with 2000. The drop was due to energy savings for 9.2 Mtoe and a decrease in passenger and freight traffic (activity effect) for 1 Mtoe. This cut was partially counterbalanced by an increase in consumption due to a modal shift effect for 0.6 Mtoe and other effects for 6.6 Mtoe, mainly low load factor in passenger and goods traffic.

Figure 19: Variation of final energy consumption in transport sector 2000 - 2022



Source: Odyssee

The 2023 Budget Law established a new fund for sustainable mobility aimed to achieve the emissions targets. The fund has an allocation of 2.2 billion euros for the period 2023-2034 intended to

finance the renewal of buses, hydrogen trains, intermodality in the freight transport of goods, alternative fuels for ships and airplanes, the transformation of airports, the renewal of road transport vehicles.

MIT-MEF Interministerial Decree n.166/2023 set "Sea Modal Shift" replacing Marebonus: new incentive program for maritime companies to road/sea shift in short-medium range maritime transport financed by 21.5 million euros per year for the years 2023-2026.

The MIT Decree n.134/2023 allocates 22 million euros per year for Ferrobonus incentives for years 2023-2026.

The energy savings achieved by sustainable mobility in recent years under the Article 8 of EED III are summarized in table 4.

Table 5: Annual energy saving in Mtoe per year by sustainable mobility

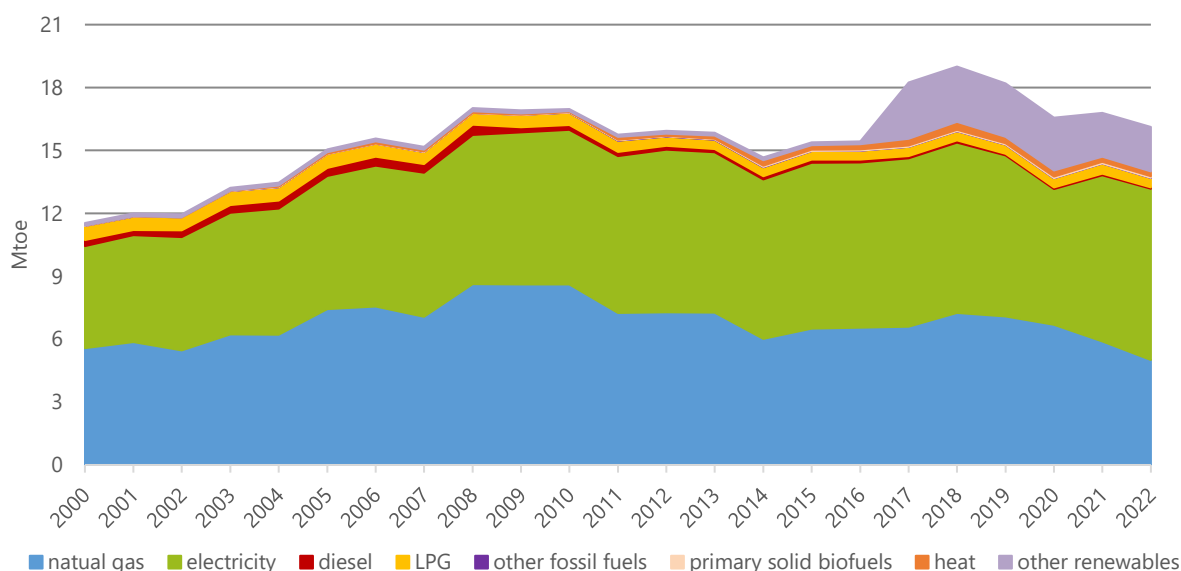
Measures	2021	2022	2023
Sustainable mobility	0.522	0.503	0.359

Source: Annual Energy Efficiency Report 2024, ENEA

4.4 Services sector

Energy consumption in services sector was 16.1 Mtoe in 2022, -4.0% compared to 2021: since the COVID19 pandemic, energy consumption amounted at around 16 Mtoe. The decrease in 2022 affected all energy sources except electricity, +3.1% compared to 2021.

Figure 20: Energy consumption in services sector by energy source

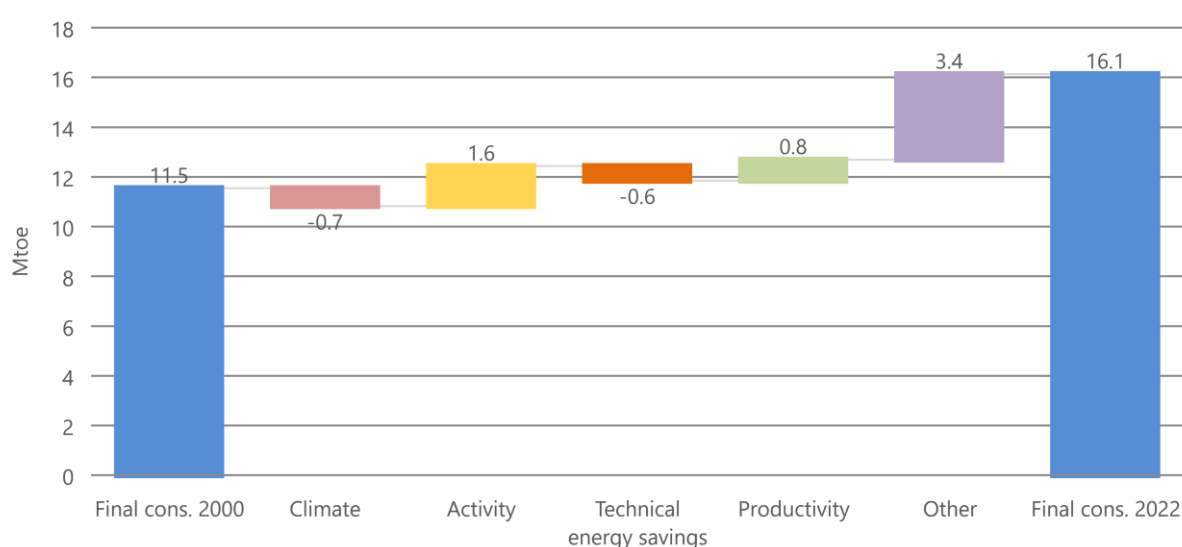


Source: Eurostat

Electricity and natural gas are the main energy sources in the sector with over 80% of total consumption. The share of natural gas fell from 40.4% in 2020 to 31.1% in 2022 due to the high prices in the last two years, on the other hand the share of electricity increased from 39.1% in 2020 to 50.7%. Renewable sources cover approximately 13% of energy consumption in sector: in particular, in 2022 ambient heat was 2 Mtoe, 12.2% of energy consumption.

The services sector is the driving sector of the Italian economy: in the period 2000-2022, energy consumption increased by 4.6 Mtoe, +40% from 2000, at an average annual rate of 1.5%, despite the drop between 2009 and 2014 and the COVID-19 pandemic in 2020. This increase is due to the activity effect for 1.6 Mtoe (linked to +17.2% in VA), productivity effect for 0.8 Mtoe and other effects for 3.4 Mtoe. Energy savings limited energy consumption increase by 0.6 Mtoe.

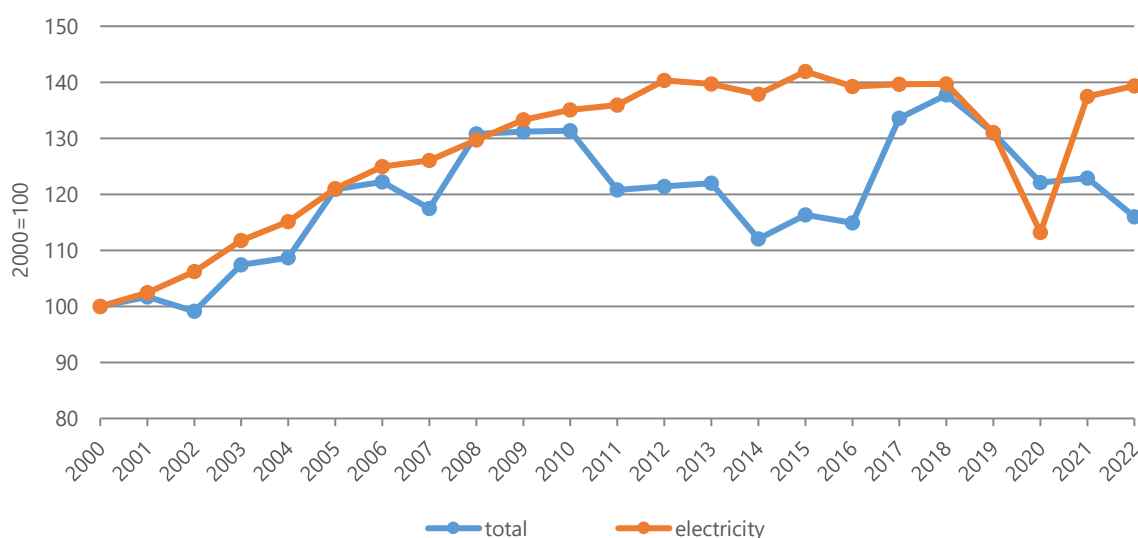
Figure 21: Variation of final energy consumption in services sector 2000 - 2022



Source: Odyssee

Energy consumption per employee in service sector had a growing trend over the period 2000-2022: 0.7% per year with the peak in 2018 due to ambient heat counting. The electricity consumption per employee grew by 1.5% per year between 2000 and 2022, with a net slow down since 2011 (only +0.2% per year). Since 2021 electricity consumption includes the electricity consumption for heat pumps.

Figure 22: Energy and electricity consumption per employee in services sector



Source: Eurostat

The 2020 Budget Law grants the Municipalities for the years 2020-2024 a maximum of 500 million euros per year in investments for

- interventions for energy efficiency of public lighting, for energy savings in public buildings and in public residential buildings and the installation of energy production plant from renewable sources.
- sustainable territorial development: interventions for sustainable mobility, adaptation to standards and safety of schools, public buildings and municipal assets.

The grant in the amount of 50% is paid after the start of the works, certified by the monitoring system, and the remaining 50% after the transmission of the testing certificate or the certificate of proper execution issued by the works manager.

5 Special focus: Energy poverty policies

The Italian strategy on Energy Poverty is still under development. The finalisation of the transposition process of the Energy Efficiency Directive recast (Directive EU 1791 of 13 September 2023) is expected to establish the definition and the measure. In this process, a relevant input will be given by the conclusion of the EPIC project (June 2025), financed by Eurostat. The Italian representatives in the consortium are GSE, AU and MASE. GSE and AU have also been appointed by the MASE as supporting institutions in the operations of the Italian National Observatory of Energy Poverty. The ONPE was established by the M.D. 29 March 2022, in application of Lgs.D. 210/2021 (transposition of the Directive EU/2019/944).

Pending the finalisation of the processes described in the previous paragraph, Italy has adopted the definition of energy poverty given by the Article 2(52) of EED III and a set of 4 EU-SILC based indicators suggested by the EU Recommendation 2023/2407 (SWD 2023/647):

- households in arrears of utility bills (percentage with respect of the total population and the sub-group of population below 60% of the median income, namely "at risk of poverty");
- households that are not able to adequately warm the house (percentage with respect of the total population and the sub-group of population below 60% of the median income).

Consequently, the current Italian policy framework for fighting energy poverty through energy efficiency deployment in buildings rely on specific provisions that make the current support schemes coherent with the objective of counteracting energy vulnerability in domestic consumption. Such schemes mostly address structural and energy renovation of buildings and the diffusion of energy efficient technology, along with applications for energy management and demand flexibility. A synthetic review is given in the following sections.

Fiscal deductions on energy and structural renovation works. Fiscal deduction measures for energy efficiency deployment in buildings mainly address energy and structural retrofitting of residential buildings. Measures for buildings' energy retrofitting in Italy account for the largest share of energy savings achieved according to the mandatory targets set by the EED (article 7 of the EED III for the period 2014-2020, and article 8 of the EED III for the period 2021-2030).

The Superbonus and the Ecobonus schemes generate about 87% of the total final energy savings from fiscal deduction measures. As of 2023, these measures accounted for specific options to facilitate access for economically disadvantaged people. In particular, the possibility to claim an invoice discount or credit's transfer from the fiscal deduction. The first one allowed to trade the amount of the tax credit of the beneficiary directly as a discount in the invoice of the service provider. The second option enabled the sale of the tax credit to third parties (mainly financial institutions). These mechanisms were expected to facilitate the access for low-income households by easing the initial capital requirements.

Additionally, following the D.L. 34/2020, specific regulation regarding maximum eligible expenditure and temporal extension of the benefit from the Superbonus were established for Third Sector Entities (art. 119, part 9-II) and social housing managers (art. 119, part 9-c). This discipline aimed to reinforce the social impact of public expenditure allocated to the decarbonization of the building stock.

Recently a substantial review of the fiscal incentives for energy retrofitting of residential buildings has occurred, partly complying with the set of reforms planned in the Italian NECP. Besides the reduction of the incentivisation percentage, significant modification of the rules for the invoice discount and credit transfer option have been made.

The Lgs.D. n.11/2023, converted into Law n.38/2023, established the interruption of the possibility of exercising these options starting from 17 February 2023. The law however outlined exceptions, among the others for TSEs and social housing. These residual exceptions were finally removed by Lgs.D. n.39/2024. The Lgs.D. 39/2024 also introduced a fund of 100 euros million specific types of interventions carried out by non-profit organizations or similar entities (art. 1-III) and the extension to 10 years of tax deductions on Superbonus (art. 4-II).

The 2025 Budget Law established a further revision of the Superbonus and Ecobonus which significantly reduced the percentage of deduction. The current legislation establishes the shares reported in Table 6.

Table 6: Ecobonus and Superbonus. Percentage of deduction by type of intervention, at current legislation

Measure	2024	2025	2026-2027
Ecobonus	<ul style="list-style-type: none"> • 50%-60%: Heating, HPs, PV • 70%-75%: Building level (condominiums) 	<ul style="list-style-type: none"> • 36%: Other than main house • 50%: main house 	<ul style="list-style-type: none"> • 30%: other than main house • 36%: main house
Superbonus	<ul style="list-style-type: none"> • 70%: Condos, 2-4 units dwellings • 110%: Interventions in zones affected by earthquakes and TSEs 	<ul style="list-style-type: none"> • 65%: (expenditure by 15/10/2024) 	Not refinanced

Thermal Account. The Thermal account was introduced by the M.D. 28/12/2012, and updated by the M.D. 16/02/2016 (Thermal Account 2.0). The incentive is in the form of a non-repayable grant managed by the GSE. Thermal Account is accessible by individuals, businesses and PA for incentivising small-scale energy efficiency and renewable energies deployment projects (insulation, heating devices, lighting systems, insulation, solar thermal, etc.). The percentage of support ranges from 40% to 65% of the expenditure incurred, depending on the type of intervention. The 65% is granted to projects for the transformation of buildings into of Nearly-Zero Energy Buildings (NZEB) and for the replacement of traditional heating systems with heat pumps, biomass boilers and appliances, hybrid heat pump systems and solar thermal systems.

The eligible expenses can be fully covered in case of projects carried out in public buildings as schools and hospitals, including interventions in facilities for residential and assistance services of the National Healthcare Service. The Thermal Account can be cumulated with other non-state incentives and within the scope of the interventions previously indicated. It also finances 100% of the costs for the Energy Audit and for the Energy Performance Certificate (APE) for PAs (and the ESCOs that continue on their behalf) and 50% for private entities and inhabitants' and social cooperatives. A substantial change of the measure is currently under discussion. Some planned new features of the Thermal Account 3.0 are intended to reinforce the prioritisation of vulnerable consumers. Among the main novelties of the measure:

- incentives for Renewable Energy Communities and Collective Self-Consumption configurations.
- equivalence between PA and TSE.
- the extension of the eligibility to projects for private non-residential buildings.

- increase of the incentive to 100% of the incurred expenditure on public buildings in small municipalities (up to 15 thousand citizens: schools, hospitals, facilities for residential and assistance service).

National Fund for Energy Efficiency (NFEE). Introduced by the L.D. 102/2014 and ruled by M.D. 22/12/2017 and 05/04/2019, with a total financial allocation of 310 million euros. The NFEE is a revolving fund articulated in two parts:

- granting of guarantees on single financing operations (30% of resources): the guarantee covers up to 80% of eligible costs within the range of 150 thousands – 2,5 million euros for a maximum extension of 15 years.
- discounted rate loan (70% of resources). The loan can range from 250 thousands to 4 million euros for financing up to 70% of the eligible costs and a maximum duration of 10 years.

PA can use the loan for up to 60% of the eligible costs. The percentage is increased to 80% for public infrastructures (public lighting included). The admissible landing is of 150 thousands – 2 million euros for a maximum period of 15 years. Moreover, in case of beneficiaries from PA, the incentive can be cumulated with other schemes, up to 100% of the total cost of the project.

The NFEE can finance projects for:

- energy consumption reduction in industrial processes.
- construction and extension of district heating networks.
- energy retrofitting of public infrastructures (including lighting).
- energy retrofitting of buildings.

The measure is coherent with the objective of reducing energy vulnerability of households since it can support the financing of renovation projects in buildings used for social housing.

National Fund Energy Income (NFEI). The National Fund Energy Income was introduced by the M.D. 8 August 2023, with a total financial appropriation of 200 million euros for the years 2024 and 2025. The incentive is in the form of a capital investment managed by the GSE. The NFEI supports the installation of photovoltaic panels for domestic use between 2 kW and 6 kW. Potential beneficiaries are household in condition of economic disadvantage, living in residential dwellings, and is aimed to promote CSC configurations and diffusion of renewable energies in the residential building sector.

The financial resources are distributed as follows:

- 80 million euros assigned to the Southern Regions and Islands areas (Abruzzo, Basilicata, Calabria, Campania, Molise, Puglia, Sardinia and Sicily);
- 20 million euros to the remaining Regions or Autonomous Provinces.

The extra energy production not self-consumed is made available for 20 years to the GSE for financing the NFEI.

Moreover, the fund can also be financed be allocated with voluntary payments by central administrations, regions, autonomous provinces, other public bodies, organizations and TSE, also channelling resources from the programmes for the use of European Structural and Investment Funds .

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